

Engineering has reviewed the plans for the Shipyard Village project submitted March 28, 2016 and have the following comments:

SWMP Application Form

1. IV. Project Information; Line Item #9: Please verify the impervious square footages in the table match Table 1 in the Proposed Improvements section of the Design Narrative. There are appears to be some discrepancies.
2. IV. Project Information; Line Item #10: This number will change due to previous comment.
3. IV. Project Information; Line Item #11: This percent may change due to previous comment.
4. IV. Project Information; Line Item #13: This number will change due to previous comment.
5. IV. Project Information; Line Item #14: There appears to be discrepancies with the drainage and impervious areas for BMP's #2 and #3 and the calculations in the Design Narrative. Please verify. Please add an extra sheet (page 4 of 7) for BMP #4, which was left out of the submittal.
6. The application lists some off-site impervious surface, which means there is off-site drainage coming through the site, yet the plans don't reflect that in the drainage areas. Please verify if there is off-site drainage coming to your site.

Stormwater Management Design Narrative

7. III. Proposed Improvements: Table – 1 Proposed Built Upon Area: See comment above in Application section.
8. Attachment 1 – Supporting Information lists sections III and IV as Infiltration Basins Infiltration Trench Calculations, but the title page where the attachments begin has the sections listed as Attachment 1 – Supporting Documentation: III. Wet Detention Pond Calculations and IV. Infiltration Basin Calculations. Please correct.
9. Pre-development curve numbers for the basins and the trench are not needed, only the post-development curve numbers are needed.
10. Please include the basin within the limits of its corresponding drainage area and recalculate curve numbers and Retention Requirements worksheets.
11. III. Infiltration Basin Calculations; All basins: Input descriptions for Area of Bottom Contour & SHWT Separation are incorrect for input value.
12. III. Infiltration Basin Calculations; Basin #2:
 - a) Drainage area (1.53 ac.) does not match application (1.55 ac.) or Basin #2 Retention Requirements DA (1.55 ac.). Please correct.
 - b) Impervious breakdown does not match impervious breakdown listed in the table (BMP #2) on page 4 of the application. Please verify.
 - c) The temporary pool elevation is listed at 53.00', but the provided treatment volume occurs at 53.50' per the stage-storage table. Please correct.
13. III. Infiltration Basin Calculations; Basin #3:
 - a) Impervious breakdown and percentage does not match impervious breakdown and percentage listed in the table (BMP #3) on page 4 of the application. Please verify.
 - b) The temporary pool elevation is listed at 52.00', but the provided treatment volume occurs at 52.20' per the stage-storage table. Please correct.
 - c) An infiltration and SHWT tests were not performed in the vicinity of Basin #3, but since the other test results for Basins #1 and #2 both showed seasonal high to be at least 60" below grade and infiltration rates in the high teens low twenties, I have no issue with using a SHWT elevation 60" below existing grade and 19.9 in/hr infiltration rate (or ½ the infiltration rate: 9.95 in/hr). However, since a layer of hardpan with an infiltration rate of 0.30 in/hr (0.52 in/hr is minimum allowable) was discovered in the vicinity of the infiltration trench, I would

suggest a boring test be performed to ensure that the hardpan layer does not extend into the vicinity of Basin #3.

14. IV. Infiltration Trench Calculations; Trench #1:

- a) Input descriptions for Area of Bottom Contour & SHWT Separation are incorrect for input value.
- b) Please provide calculation for Provided Treatment Volume of 10,688 cf.
- c) Please verify the temporary pool elevation (TP=52.00').
- d) The infiltration rate at the depth at the bottom of the trench per the testing is 0.30 in/hr, which is less than the minimum allowable (0.52 in/hr). There appears to be a 20-inch layer of hardpan that the trench will be above, therefore the trench will not function as designed. Please seek a recommendation from the professional engineer with ECS as to how to deal with the hardpan in order to return the underlying soil to a state with an acceptable infiltration rate for the proper functioning of the infiltration trench.

15. V. Hydraflow Calculations:

- a) Note only: The 2, 10 and 25-yr/24 hour rainfall depths (4.77, 7.41, and 9.32) are larger than required (4.50, 6.72 and 8.01). I am not requiring you to change them because your depths are larger than required. Just letting you know.
- b) Rainfall Distribution should be Type III instead of Type II for all models. Please revise.
- c) Per the meeting T. Murphy and I had on May 19, 2016, the pre-development hydrographs for the infiltration basins and infiltration trench can be omitted. Pre-development runoff was discussed to be calculated in a different manner.
- d) Pond Report; IB #2: The outlet pipe was selected to be inactive (Rise (in))?. Please verify.
- e) Pond Report; IB #2: There appears to be a discrepancy regarding the invert elevation when compared to the plans. Please verify.
- f) Pond Report; IB #3: There appears to be a discrepancy regarding the pipe size, pipe length and invert elevation when compared to the plans. Please verify.
- g) Pond Report; IB #1A: There appears to be a discrepancy regarding the outlet pipe length when compared to the plans. Please verify.
- h) Pond Report; IT #1: There appears to be a discrepancy regarding the pipe size, pipe length and pipe slope when compared to the plans. Please verify.
- i) Pond Report; IT #1: Verify the infiltration rate per comment 14(d) above.

16. VI. Storm Pipe/Structures:

- a) The 10-yr pipe design and HGL Table does not match the Storm Drainage Structure Data Table or the Storm Drainage Pipe Data Table on CG-101. There are differences with the inlet to outlet sequence, inverts, pipe lengths, pipe diameter, slope, and rim elevations.
- b) CB-2 is flooded in the 10-yr storm. (Rim: 56.45; HGL: 56.61).
- c) Note only: The system intensity exceeds what is required. The required 10-yr, 5 minute intensity = 7.23 in/hr. The chart uses 9.67 in/hr. If the intensity were to be reduced, the flooding in CB-2 would occur.
- d) Please add the modified stormdrain system along CB Road in your calculations.
- e) Note only: I did not review the 25-year due to the inconsistencies with the 10-year chart. Again, the system intensity is much larger than what is required...11.89 in/hr v. 8.87 in/hr. You do not have to change either intensities as they are larger than required.

17. Inlet Spread Analysis: Spread will only be required for structures in NCDOT or City right-of-ways. CB-8, CB-9 and CB-15 are the only structures requiring spread calcs. CB-15 was not included in the spread analysis. Spread shall not exceed eight (8) feet or 1/3 of the street width, whichever is less, during a 10-year event.

18. The catchment table in the calculations does not match the chart on CG-002 (DA-2). Inlet drainage areas and the "C" values are different from table to table. The chart on DA-2 has duplicate structures. The stormdrain layout on DA-2 is not current with the layout on CG-101 (Sheet 11). The structures added to CB road are not included. Please correct.
19. Please recheck the energy dissipater calculations for IB #4 and IT #1. The slopes and pipe sizes vary from calcs to the plans.

Infiltration Basin Supplements

20. IB #1 Supplement; Additional Information: Maximum runoff to each inlet to the basin? Revise to 0.50 ac-in. (The calculation is Required Treatment Volume (cf)/3,630cf....1,808cf/3,630cf = 0.50 ac-in.)
21. IB #2 Supplement:
 - a) Site Characteristics; Drainage Area: Enter the correct DA so the percent impervious will calculate correctly.
 - b) Storage Volume: Non-SA Waters: Revise minimum design volume to match calcs.
 - c) Additional Information: Maximum runoff to each inlet to the basin?: Please revise.
22. IB #3 Supplement:
 - a) Storage Volume: Non-SA Waters: Revise minimum design volume to match calcs.
 - b) Basin Design Parameters; Basin side slopes: Handwrite in that a retaining wall is being used.
 - c) Basin Design Parameters; Storage elevation: Verify storage elevation is correct throughout submittal.
 - d) Additional Information: Maximum runoff to each inlet to the basin?: Please revise.
23. IT #1 Supplement:
 - a) Storage Volume: Non-SA Waters: Volume provided does not match calculations.
 - b) Soils Report Summary; Infiltration Rate: Need to revise per earlier comments.
 - c) Trench Design Parameters; Drawdown time: Need to revise per earlier comments.
 - d) Trench Design Parameters; Perforated pipe length: Doesn't match plans.
 - e) Trench Design Parameters; Number of laterals: Doesn't match plans.
 - f) Trench Elevations; Storage/overflow elevation: Doesn't match plans.
 - g) Trench Dimensions; Length, width, Height: Please match with plans.
24. Level Spreader, Filter Strip...Supplement: Verify that a level spreader and vegetated filter strip is required: see Chapter 16 (16.3.9). I do not see a level spreader or vegetated filter strip on the plans.

Operation & Maintenance Agreements

No comments.

General

25. **Note only** - The minimum size storm drain pipe shall be 12 inches unless the pipe will be part of the NCDOT system, in which case NCDOT minimum pipe size requirements shall apply. Carolina Beach Road is state maintained, therefore the work being proposed inside the CB Road right-of-way will need to be approved by NCDOT.
26. Headwalls or flared end sections shall be required at the inlet and outlet of all pipe systems.
27. Per the Technical Standards, the infiltration facilities are to be checked for the 50-year storm. Please include the 50-year storm in your calculations.

28. Per the Technical Standards, An emergency outlet or overflow device shall be designed such that in the event of a system failure (i.e. stormwater will not infiltrate) during the 10-year storm, stormwater will be conveyed to an existing drainage way or structure and not damage property. An emergency outlet or overflow device for the 50-year storm shall be provided (i.e. piped system, driveway, overland flow, etc.). An emergency outlet or overflow device may be waived if the infiltration system is not overtopped by the 100-year storm using half the infiltration rate determined from testing and does not damage or flood property. Please submit the 100-year storm analysis if you intend to waive the emergency outlet or overflow device for the infiltration devices. Must request variance(s) in writing in order to waive emergency outlet or overflow device requirement.

Plans

29. Note only – The sheet numbering does not match the sheet index.
30. CS-101: Please verify the Impervious Area (Proposed) section of the Site Data Table. Make sure the impervious areas are quantified in a manner that is consistent throughout the plans, calculations and supplements.
31. CS-101: Quantify on this sheet any impervious areas that are demolished within the Carolina Beach Road right-of-way.
32. CS-101: It appears that a portion of the proposed street and associated curb & gutter and sidewalk encroaches onto the southern adjacent property. Please coordinate with City and NCDOT for easement requirements.
33. CS-102: Provide finished grade contours and spot grades to illustrate how the proposed street will tie into the existing grade. Add spot grades along proposed sidewalk. Grading around existing structure is of particular interest. What is FFE of existing structure?
34. CS-102A:
- a) Adjacent property will require a new driveway per city standards where new turn lane has been added. Please coordinate with NCDOT and show on plans.
 - b) Please add inverts to existing and proposed catch basins along Carolina Beach Road to ensure positive drainage.
 - c) Add spot elevations to existing edge of pavement and proposed edge of pavement along turn lane to illustrate how this area is to be graded.
35. CG-101:
- a) Please make sure the data tables for the structures and pipes are complete and accurate per earlier comments.
 - b) Turn on the tree layers in the insets. Only the calipers of the trees are on.
 - c) CB-9 invert out in structure table is incorrect.
36. CG-102:
- a) There are “???” for spot elevations at the proposed street intersection with CB Road.
 - b) Verify the spot elevation for CB-2 with the rim elevation on CG-101 to make sure the area will grade properly.
37. CU-101: RPZ and RPDA are shown on top of the storm pipe. Please consider removing them from their present location to eliminate conflict.
38. Please verify that there are no conflicts between the sanitary sewer and stormdrain pipes.
39. CL-101: Hatching for IB #3 is not shown.
40. CS-501: Please use the city standard detail SD 3-11 for curbing.

41. CN501:

- a) Please place the upstream end of the outlet pipe at the correct elevational location for both basins.
- b) Add headwalls or flared end sections at all pipe inlets and outlets per earlier comment.
- c) Add energy dissipater at outfalls.
- d) Move Bottom Elevation text above the top of the clean sand in both cross-sections.
- e) IB #2: grading near sidewalk is steeper than 3:1. Please revise.
- f) IB #2: Verify upstream invert elevation of outlet pipe and storage elevation.
- g) IB #2: Verify pipe length, size and slope of outlet pipe with calculations.

42. CN502:

- a) IB #3: Verify seasonal high water table elevation.
- b) IB #3 Add headwalls or flared end sections at all pipe inlets and outlets.
- c) IB #3: Add energy dissipater at outfall.
- d) IB #3: Move Bottom Elevation text above the top of the clean sand.
- e) IB #3: Verify pipe length, size and slope of outlet pipe with calculations.
- f) IT #1: Verify 10, 25 and 50-yr WSEL with calculations. Add 1.5" WSEL.

43. DA-1:

- a) Rework pre and post-development runoff calculations per our meeting.
- b) Verify roof drain plans so runoff gets to correct BMP. Show roof drain leaders if you can to verify roof drainage patterns.
- c) Include BMP in its corresponding drainage area.
- d) Verify post-development curve numbers with calculations.

44. DA-2:

- a) Verify stormdrain layout matches plan.
- b) Verify drainage areas match grading plan.
- c) Verify chart information is correct against the calculations.
- d) Add DA for CB road structures.
- e) Verify roof drain plans so runoff gets to correct BMP. Show roof drain leaders if you can to verify roof drainage patterns.

Please submit one complete set of plans, full set of calculations and supporting documentation to Engineering for additional review. Please call or email if there are any questions. Thank you.